

## Appendix H Configuring the GRM Registry Files

### Introduction and overview

There are at minimum three General Resource Manager registry files that need to be configured. Each of the three types has its own section and set of instructions.

The first registry file is located on a “Master Control” computer; the second two (or more) registry files are located on (various) Node computer(s).

It is unlikely that a “Master Control” computer will have more than one registry file. The “Master Control” computer GRM is simply denoted the “Master” GRM.

Master-Node communication is executing between the GRMs. Successful communication depends on procedures, as well as the existence of the “Developer” or “Operator” accounts on the Master PC.

On the other hand, a “Node” networked computer requires two General Resource Managers and two corresponding General Resource Manager registry files. One General Resource Manager is responsible for controlling the various attached instruments. This General Resource Manager is denoted the “Device” GRM. The other General Resource Manager is responsible for tracking station “operations” and is denoted the “Operations” GRM.

The “Operations” and “Device” General Resources Managers will be chained together in a master/slave relationship with the “Operations” GRM serving the role of master for the two. In turn, this pair will be chained to yet another GRM, the “Master” GRM, which will then assume the role of “master.” This “Master” GRM is most likely resident on another networked computer. The net result of all this will be at minimum a three-GRM chain distributed over two networked computers. Through judicious registry file setup the chaining of GRMs could potentially continue all across a world-wide network.

The technique of configuring a GRM registry file is to take a ready-made (template) registry file that contains just about every possible entry that would want to be known by a GRM in an Automated Tracking Station and tailor it to the specific installation of interest.

This tailoring is done in one of two ways: 1) by uncommenting various lines of text within the registry file you are editing, effectively “turning on” that portion of the registry, or, 2) by copying the appropriate lines from the template registry file to your being edited registry file and then “tuning” them to your requirements.

### First, Some Vital Fundamentals

Let's introduce some crucial concept areas such as “Port”, “Resource” and “Connection.” A clear understanding of these as they are understood by a General Resource Manager is supremely important.

#### Ports For The Non-seafaring

A “port” is what a General Resource Manager uses to detect the presence of and communicate with “targets”, be they a specific instrument directly connected to a networked computer or another General Resource Manager, also on a networked computer. Careful specification of “port” settings in a GRM registry file provides the General Resource Manager the “message transport machinery” to use when it starts and looks for what it anticipates will be able to be seen by itself.

For a specific instrument a “Port” entry in the “Device” GRM registry file will most often have the settings of an RS-232 style port on the computer to which the instrument is connected directly.

For the “operations” control of a type of instrument a “Port” entry in the “Operations” GRM registry file will have the name of a “pipe” that will be used to funnel messages from the “Operations” GRM to the “Device” GRM that is aware of and handling directly connected instruments.

For the “master control” of a collection of “Operations” GRMs a “Port” entry in the “Master” GRM registry file will have the name of a “pipe” that will be used to funnel messages from the “Master” GRM to a specific “Operations” GRM. Note that this is similar in appearance to that of the “operations” control style just mentioned.

## Resources For The Resourceful

The concept of “Resources” is a broad and slippery topic in the design of our General Resource Manager. In its pure sense, a “Resource” can be most anything: a specific instrument listed with a designated unit number, the “operational scripting” of a collection of instruments of the same type, or yet-another-General Resource Manager. Careful specifying of the “Resources” for a particular GRM is vital when chaining one GRM to another GRM.

For a specific instrument a “Resource” entry in the “Device” GRM registry file will most often have the name of the type of instrument and a designated unit number. Note that in this model, complete computer systems can be thought of as being an instrument of a specific type.

For the “operations” control of a type of instrument a “Resource” entry in the “Operations” GRM registry file will have the name of the “Operations Scripting Class” of a specific type of instrument along with either the DNS-style name or IP address of the computer on which the “Device” GRM is located. Most frequently the “Operations” GRM and the “Device” GRM will be located on the same “Node” networked computer, but this is not an absolute requirement. There are at minimum two “Resource” entries in a registry file for an “Operations” GRM: at least one to designate which “Device” GRM(s) are to receive the flow of messages to and from this “Operations” GRM and at least one entry for an “Operations Scripting Class” of a type of instrument.

For the “master control” of a collection of “Operations” GRMs a “Resource” entry in the “Master” GRM registry file will have the DNS-style name or IP address of the networked computer on which the “Operations” GRM is located. Most often this is a separate networked computer, in contrast to that of “Operations” GRMs and “Device” GRMs being on the same networked computer, but this is not an absolute requirement. There are at minimum two “Resource” entries in a registry file for a “Master” GRM: one to designate which “Operations” GRM(s) are to receive the flow of messages to and from this “Master” GRM and at least one entry for a “Remote Node” networked computer.

The concept of a “Remote Node” computer is essentially this: to start GRM processing you need a “seed” to feed the sequence. A General Resource Manager exists in its own right. It is aware of who feeds it, along with who should be fed by it only through the interpretation of entries in its corresponding registry file.

Recall that General Resource Managers can be chained, much like a linked-list. The entry for “Remote Node” is in essence the head of a linked list of chained together sub General Resource Managers. The “Master” GRM can be considered at the top of this food chain under the control of a process that will feed this GRM.

The design of the “Master Control” software originally did not call for a “Resource Manager”. The design of a General Resource Manager called for it to be totally non-dependent upon which process fed it and which processes it, in turn, fed. There needed to be a way to have a General Resource Manager become aware of the process that fed it along with the “Master Control” processes become aware of a “Resource Manager.” This is handled by the introduction of the entry into the “Master” GRM registry file called “Remote Node” which provides a “source” to the GRM from which to receive messages. Observe that the “Remote Node” entry in the “Resources” section has a bracketed section with a “1” and the “.” character.

This indicates that the “master control” process that feeds the “Master” GRM resides on the same computer as does the “Master” GRM and that the process is designated with a “ProgramId” is 1.

## Connections Bring It All Together

Finally we move into the “Connections” section of a GRM registry file. As was the case with the “Ports” and “Resources” sections the “Connections” section has its own collection of things that must be known about. You will note that after scanning the “Ports” and “Resources” sections in a registry file that there is not yet any binding between an entry in the “Resource” section and a corresponding entry in the “Ports” section. It is the “Connections” section which binds these other two sections together.

For a specific instrument a “Connections” entry in the “Device” GRM registry file has two parts. The first part is the type of port and its number to which the instrument is connected. The second part is the name of the type of instrument and its designated unit number. Note that these items are pulled from the “Ports” and “Resources” section of the same registry file.

For the “operational” control of a type of instrument a “Connections” entry in the “Operations” GRM registry file also has two parts. This time the first part is the name and number of a “pipe” from the “Pipe” section. The second part is the “Operations Scripting Class” of a specific type of instrument along with the number of \*\*\*needs more explanation \*\*\* which is to flow control through the chosen pipe. There are at minimum two “Connections” entries in a registry file for an “Operations” GRM: at least one to designate which “Device” GRM(s) are to receive the flow of messages from this “Operations” GRM and at least one entry for an “Operations Scripting Class” of a type of instrument. Observe that an entry for the “Device” GRM entry will have a digit indicating the “ProgramId” of the “Device” GRM to which this “Operations” GRM is to be chained.

For the “master control” of a collection of “Operations” GRMs a “Connections” entry in the “Master” GRM registry file also has two parts. This time, as was the case with the “Operations” GRM registry file “Connections” section, the first part is the name and number of a “pipe” from the “Pipe” section. The second part is the “Operations” GRM “ProgramId” which is to receive the flow of messages from this “Master” GRM. There are at minimum at least two “Connections” entries in a registry file for a “Master” GRM: one to designate which “Operations” GRM(s) are to be chained and receive the flow of messages from this “Master” GRM and at least one entry for a “Remote Node” networked computer.

The concept of a “Connection” entry for a “Remote Node” computer is essentially this: to feed a GRM you first need a “pipe” from which the GRM is to receive its messages. Next you need to designate a “Resource” to and from which the “Master” GRM will communicate. The “Remote Node” “Connection” entry binds these two items together.

## Tuning and Tweaking Your Registry Files Overview

The tune and tweak process essentially follows this sequence: get two workspaces loaded with the desired file(s), then tune and then tweak the various sections in the file you want to save.

We will configure the Master Control computer registry file first and then move on into a Node networked computer and configure the registry files for “Operations” and “Devices.”

The tune and tweak starts first with “Ports”. Your tune and tweak will continue with “Resources” and then continue on into “Connections.” You will finish up a registry file by specifying a couple of values in the “Configuration” section.

## To Configure the Master Registry File

- ☐ Start the Notepad text editor.
- ☐ Open the file “GRMBase.reg” from the c:\Master\Regs \*\*\* check this location \*\*\* directory in Notepad. You will use this file as a template to supply lines of text that will be copied to another text file.
- ☐ Start a second copy of the Notepad text editor. (Unlike fancy word-processors, Notepad is not able to have two files opened at the same time for editing. To open another file you must start a second copy of Notepad.)
- ☐ Check to see if you have a file named “GRM.reg” in your c:\Master\Regs directory. If so, then open this file into your second copy of Notepad. If not, then open the same “GRMBase.reg” file into your second copy of Notepad and then “Save As” this workspace as “GRM.reg” into the c:\Master\Regs directory.
  - ☐ Note what you did to obtain your workspace copy of the “GRM.reg” file. If you opened an existing file you will do the following steps by copying lines of text from the “GRMBase.reg” into your “GRM.reg” file in appropriate areas.
  - ☐ On the other hand, if you created your “GRM.reg” file by making a copy of the existing “GRMBase.reg” file, you will then proceed by uncommenting lines of text from your new “GRM.reg” file and then make the appropriate adjustments.
- ☐ In the “Port” section of your GRM.reg file create a pipe port for each “Node” networked computer in the tracking station by copying a line with the pipe port information from the “Port” section of the opened GRMBase.reg file. Also create one pipe port for the to-be-created “RemoteNode” resource. Number the pipe ports sequentially starting with zero. An explanation of what’s going on with this “RemoteNode” is in a later section.
  - ☐ Example lines for the “Port” section of the “Master” GRM registry file follow:
    - ☐ \Pipe\0
    - ☐ \Pipe\1
- ☐ In the “Resources” section of GRM.reg create a “GRM” resource for each “Node” networked computer of which you want the “Master” GRM to be aware. Make the resource entries by copying the information from “Resources” section of the GRMBase.reg file. Review the introduction above regarding “Resources” and the “Master” General Resource Manager.
  - ☐ Note from the following example line that the “GRM” line has the “ProgramId” of the target General Resource Manager to and from which messages are sent and received. The bracketed section on this line contains a “unit number” and the DNS style name of the computer where the target, chained, GRM resides. You may optionally specify the target computer using the target computer’s IP address.
  - ☐ An example line for the “Resources” section follows:
    - ☐ \GRM\2 [0 SGSNode]
- ☐ In the “Resources” section of the GRM.reg file create an entry for a “RemoteNode” resource by copying the resource information from the “Resources” section of the GRMBase.reg file. Observe that the “RemoteNode” example line has a unit number of “1” and a “.” character indicating that the “target” machine for the “RemoteNode” resource is the same machine as where the “Master Control” GRM resides. Recall that the “.” is short-hand notation for “same computer” when directly specifying a numeric IP address.
  - ☐ An example line for the “Resources” section of the “Master” GRM registry file follows:
    - ☐ \RemoteNode\0 [1 .]
- ☐ In the “Connections” section of the GRM.reg file create a “connection” entry for each “resource” by copying the connection information from the “Connections” section of the GRMBase.reg file. Review the introduction above regarding “Connections” and the “Master” General Resource Manager.
  - ☐ Note from the following example lines that the first entry binds the first pipe port from the “Ports” section to the “target” GRM from the “Resources” section, whereas the second entry binds the second pipe port from the “Ports” section to the “RemoteNode” from the “Resources” section.

- ☐ Example lines for the “Connections” section of the “Master” GRM registry file follow:
  - ☐ \Pipe\0\GRM\2
  - ☐ \Pipe\1\RemoteNode\0
- ☐ You're almost done with the “Master” GRM registry file. To finish up the GRM.reg file you now need to go to the “Configuration” section and set the “ProgramId” to “1”.
- ☐ Finish off “Master” tune and tweak by ensuring that the “MaxResources” entry count is sufficient for the number of resources in this GRM registry and the GRM registries on all of the “Node” network computers. Observe that you will need to visit each of the Node computer registry files first to obtain a count prior to finishing off this step with a value.

## To Configure the (Node) Device Registry File

- ☐ The steps in this sequence are similar to the Master registry file configuration.
- ☐ Just as a reality check, this sequence assumes that you have moved from the “Master” computer over to another console and keyboard attached to a “Node” computer. It is possible, though highly unlikely, that both the “Master” and “Node” systems are located on the SAME computer. As of May, 1999 there is only one known instance of this and it is located at McMurdo Ground Station in Antarctica.
- ☐ As you did for the “Master” GRM registry file, open the template file “GRMBase.reg” from the c:\Node\Regs directory in Notepad. \*\*\* Note the different location! \*\*\* \*\*\* Is this the same file? \*\*\*
- ☐ Do a “Save As” and save the template file into c:\Node\Regs directory using a name of GRM#\*.reg where the “#” is the number of the combination of the “Device” GRM position in a list of chained GRMs and the number of the Node networked computer where this file resides.
  - ☐ The number of your Node may be determined by establishing the position of this Node within the collection of Node networked computers within a tracking station. You will then determine where this registry file lives along a sequence of chained together General Resource Managers. If there is only one Node in a tracking station, then the position of this Node is obviously 1. If there are more Node networked computers, then they will be numbered sequentially starting with 1. The number of a “Device” GRM in a multi-node tracking station is “\*#”, where the “\*” is the number of the Node in the list of Node networked computers in a tracking station and the “#” is the position of the “Device” GRM within the collection of chained together GRMs. If there is only one Node in a tracking station then the first digit of “1” is omitted from the GRM number and is implied.
    - ☐ Example: The number of a “Device” GRM in a single Node tracking station is “3”, since it is the 3<sup>rd</sup> member of the GRM chain. The 2<sup>nd</sup> member of a GRM chain is usually the “Operations” GRM which will be covered in the next section.
    - ☐ Example: The “Device” GRM registry file on the 3<sup>rd</sup> Node networked computer in a tracking station would be named “GRM33.reg.”
- ☐ Start a second copy of Notepad as you did with the “Master” GRM.reg registry file.
- ☐ Open the “GRMBase.reg” template registry file once again, from the c:\Node\Regs directory into the second copy of Notepad.
- ☐ Make a list of all of the instruments directly connected to this Node networked computer. Then establish the port setting for each instrument (baud rate, parity, stop bits, etc as appropriate) along with the COM port number. Review the table in this section that details how to specify COM port settings.
  - ☐ If your instrument is connected to a Digibox multi-serial port device you will select a COM port number based upon which jack the instrument's cable is connected. Jack #1 on a Digibox corresponds to COM 3 on the Node. Jack #2 on a Digibox corresponds to COM 4 on the Node, and so on all the way up to COM 18 for a 16 jack Digibox. There may be additional chained Digibox units. The numbering sequence continues the same on up through the additional Digiboxes.
  - ☐ Note which instruments are connected through any port adapters such as an IO-Tech IEEE488 to RS-232 converter. Converter-adaptor devices do not have typical COM port information such as baud rate and parity.
- ☐ In the “Port” section of your newly created “GRM#\*.reg” registry file create a “port” entry for each instrument directly connected to this Node by copying the corresponding port information for that instrument from the GRMBase.reg file. Note that the GRMBase.reg template file instrument “port” entries should have the COM port settings (baud, parity, stop bits and the like) already specified for a

selected instrument. All you should have to do for a standard RS-232 style instrument is to supply a correct COM port number.

Table of RS232 Settings in a "Device" Register File

Following the name and unit number of the RS232 port is a list enclosed in brackets that specifies the serial port's baud, stop bits, data bits, parity, and overlapped I/O. The list is in the form

```
[bb ss dd pp o]
```

where bb specifies the baud rate setting,  
 ss specifies the stop bits setting,  
 dd specifies the data bits setting,  
 pp specifies the parity setting, and  
 0 specifies the overlapped I/O flag.

The list is column dependent.

Baud Rate		Stop Bits		Data Bits		Parity	
Setting	Meaning	Setting	Meaning	Setting	Meaning	Setting	Meaning
1	300	1	1	1	7	1	None
2	600	2	1.5	2	8	2	Even
3	1200	3	2			3	Odd
4	2400					4	Mark
5	4800						
6	9600						
7	19200						
8	38400						

Example: To specify a setting of 9600 baud, 1 Stop bit, 8 Data bits, and no parity, use [ 6 1 2 1].

- ☐ Observe in the example lines that the COM port number follows the field for specifying what type of port is in use. The bracketed section contains the baud rate, stop bits etc for that port.
- ☐ Example lines for the "Port" section of the "Device" GRM registry file follow:
  - ☐ \RS232\1 [ 6 1 2 1]
  - ☐ \RS232\3 [ 4 1 2 1 ]
  - ☐ \RS232\4 [ 7 1 2 1 00]
  - ☐ \RS232\6 [ 6 3 2 3]
  - ☐ \RS232\7 [ 5 1 2 1]
  - ☐ \RS232\8 [ 6 1 2 1 00]
  - ☐ \RS232\9 [ 6 1 2 1 00]
  - ☐ \IOTechIEEEConverter\1
  - ☐ \Channel\1 [10]
- ☐ In the "Resources" section of the GRM#\*.reg registry file create a "resource" entry for each instrument on the Node by copying the corresponding resource information for that instrument from the GRMBase.reg template registry file. Select a unit number for each instrument. Note that an entry with a bracketed section indicates that a complete computer system is being viewed as an instrument. Such a computer may have special resource information. Observe the trailing space inside of the closing bracket.
  - ☐ Our WifTdf example line has a "TDF" computer being viewed as a resource. The bracketed information is the DNS-style name of the machine. The trailing space is so that the closing bracket will not be viewed as part of the DNS-style name. You could have optionally placed the numeric IP address (with a trailing space) in the brackets.
- ☐ Example lines for the "Resources" section of the "Device" GRM registry file follow:
  - ☐ \Aydin329A\1
  - ☐ \Decom7715\1
  - ☐ \GDP233\1
  - ☐ \HP3325B\1

- ☐ \Krohnhte3905B\1
- ☐ \MetrumBVLDS\1
- ☐ \WffTdf\1 [WffTdf ]
- ☐ Count the number of entries in the “Resource” section. It should be the same as the number of entries in the “Port” section of your GRM#\*.reg registry file. Take a minute to review the concepts behind a “connection” in a registry file where a “port” is bound to a “resource.”
- ☐ In the “Connections” section of the GRM#\*.reg registry file create a “connection” entry for each instrument “port / resource” pair on the Node by copying the corresponding connection information from the GRMBase.reg template registry file.
  - ☐ Example lines for the “Connections” section in the “Device” GRM registry file follow:
    - ☐ \RS232\3\MetrumBVLDS\1
    - ☐ \RS232\4\Decom7715\1
    - ☐ \RS232\6\Aydin329A\1
    - ☐ \RS232\7\HP3325B\1
    - ☐ \RS232\8\GDP233\1
    - ☐ \RS232\9\WffTdf\1
    - ☐ \RS232\1\IOTechIEEEConverter\1\Channel\1\Krohnhte3905B\1
  - ☐ Observe, for example, the “Connections” entry for the “Aydin329A” instrument. You will note that it is a combination of the entry from the “Port” section for a port of type “RS232”, located on “COM 6” (with options [6 3 2 3]) and the entry from the “Resources” section for a resource of type “Aydin329A”, unit #1. A “Connections” section entry will not have the port options, just the port type and the COM number in the “port” section. The same “Connections” entry will have both the resource type and the unit number in the “resource”
- ☐ Take a minute to review how GRM numbers are established for a Node networked computer.
- ☐ In the “Configuration” section of GRM#\*.reg registry file set the value of the “ProgramId” to the position that this GRM resides in the GRM chain and ensure that the “MaxResources” count is sufficient for the number of resources declared in this registry. Remember that this count will factor into the number of resources in the “Master” GRM registry file. You may need to revisit the “Master” GRM registry file to tune its “MaxResources” value.

## To Configure the (Node) Operations Registry File

- ☐ There are steps in this sequence that are similar to the “Device” registry file configuration.
- ☐ As you did for the Device registry file, open the template file “GRMBase.reg” from the c:\Node\Regs directory in Notepad.
- ☐ Do a “Save As” and save the template file into c:\Node\Regs directory using a name of GRM#\*.reg where the “#\*” is the number of the combination of the “Operations” GRM position in a list of chained GRMs and the number of the Node networked computer where this file resides.
  - ☐ Once again, the number of your Node may be determined by establishing the position of this Node within the collection of Node networked computers within a tracking station. Most likely it will be the same as where the “Device” GRM resides that you just completed. You will then determine where this registry file lives along a sequence of chained together General Resource Managers. If there is only one Node in a tracking station, then the position of this Node is obviously 1. If there are more Node networked computers, then they will be numbered sequentially starting with 1. The number of an “Operations” GRM in a multi-node tracking station is “\*#”, where the “\*” is the number of the Node in the list of Node networked computers in a tracking station and the “#” is the position of the “Operations” GRM within the collection of chained together GRMs. If there is only one Node in a tracking station then the first digit of “1” is omitted from the GRM number and is implied.
    - ☐ Example: The number of a “Operations” GRM in a single Node tracking station is “2”, since it is the 2<sup>nd</sup> member of the GRM chain.
    - ☐ Example: The “Operations” GRM registry file on the 3<sup>rd</sup> Node networked computer in a tracking station would be named “GRM32.reg.”
- ☐ Start a second copy of Notepad as you did with the Device registry file.

- ☐ Open the “GRMBase.reg” template registry file once again, from the c:\Node\Regs directory into the second copy of Notepad.
- ☐ Make a list of all types of instruments that will be controlled through the “Operations” GRM.
- ☐ In the “Port” section of your newly created “GRM#\*.reg” Operations registry file create a “pipe port” entry for each instrument that you created a port entry for in the “Device” GRM registry file. Create the “pipe port” entries by copying the corresponding port information for that instrument from the GRMBase.reg file. The pipe port will be used by the device’s corresponding operations. Also create a pipe port to be used to chain to and communicate with the “Device” GRM. Number the pipe ports sequentially starting with zero.
  - ☐ Example lines for the “Port” section of the “Operations” GRM registry file follow:
    - ☐ \Pipe\0
    - ☐ \Pipe\1
    - ☐ \Pipe\2
    - ☐ \Pipe\3
    - ☐ \Pipe\4
    - ☐ \Pipe\5
    - ☐ \Pipe\6
- ☐ Next chain the “Device” GRM to this “Operations” GRM. Chaining is done by creating a special “resource” for the “Device” GRM that is to be controlled by the “Operations” GRM in the “Resources” section of the “Operations” GRM#\*.reg registry file. Make sure that this GRM resource is listed before all of the other “instrument” resources.
- ☐ Continuing along in the “Resources” section create a “resource” entry for each type of instrument to be controlled in the “Device” GRM. Create the entries by copying the corresponding resource information for that instrument from the GRMBase.reg template registry file.
  - ☐ Our Aydin329AOps example line has the “Operations Class” for an “Aydin329A” type of instrument. The bracketed information is the “ProgramId” of the “Operations” GRM which will communicate with the “Device” GRM along with the DNS-style name of the machine. You can optionally substitute the numeric IP address for the DNS-style machine name in the brackets.
  - ☐ Example lines for the “Resources” section of the “Operations” GRM registry file follow:
    - ☐ \GRM\3 [0 SGSNode]
    - ☐ \MetrumBVLDSOps\1 [2 SGSNode]
    - ☐ \Krohnkite3905BOps\1 [2 SGSNode]
    - ☐ \HP3325BOps\1 [2 SGSNode]
    - ☐ \Decom7715Ops\1 [2 SGSNode]
    - ☐ \Aydin329AOps\1 [2 SGSNode]
    - ☐ \GDP233Ops\1 [2 SGSNode]
- ☐ Count the number of entries in the “Resource” section. It should be the same as the number of entries in the “Port” section of your GRM#\*.reg registry file. Take a minute to review the concepts behind a “connection” in a registry file where a “port” is bound to a “resource.”
- ☐ In the “Connections” section of the GRM#\*.reg registry file create a “connection” entry for each instrument type “port / resource” pair on the Node by copying the corresponding connection information from the GRMBase.reg template registry file.
  - ☐ Example lines for the “Connections” section in the “Operations” GRM registry file follow:
    - ☐ \Pipe\0\GRM\3
    - ☐ \Pipe\1\MetrumBVLDSOps\1
    - ☐ \Pipe\2\Krohnkite3905BOps\1
    - ☐ \Pipe\3\HP3325BOps\1
    - ☐ \Pipe\4\Decom7715Ops\1
    - ☐ \Pipe\5\Aydin329AOps\1
    - ☐ \Pipe\6\GDP233Ops\1
  - ☐ Observe, for example, the “Connections” entry for the “Aydin329A” instrument. You will note that it is a combination of the entry from the “Port” section for a pipe port numbered “5”, and the entry from the “Resources” section for a resource of type “Aydin329AOps”, unit #1. A “Connections” section entry will not have the port options, just the number of the pipe port as designated in the “port” section. The same “Connections” entry will have both the resource “operations” type and the unit number.



- ☐ Note that in contrast to the “Device” GRM registry file, the ordering of the pipe ports, with the exception of the one selected for GRM use, is not critical. Recall that you must be mindful of the physical connection of an instrument to a specific COM port in the “Device” GRM registry, i.e. there must be a physical match of an instrument on the port and what is listed in the “Device” GRM registry. COM ports could be numbered anything, but must physically exist and have an actual instrument attached.
- ☐ On the other hand, in the “Operations” GRM registry it is different in that only the total number of pipe ports is of interest and that pipe ports must be sequentially numbered. Excepting the GRM pipe port, any “operations” instrument can be assigned to any pipe port within the list.
- ☐ Take a minute to review how GRM numbers are established for a Node networked computer.
- ☐ In the “Configuration” section of GRM#\*.reg registry file set the value of the “ProgramId” to the position that this GRM resides in the GRM chain and ensure that the “MaxResources” count is sufficient for the number of resources declared in this registry. Remember that this count will factor into the number of resources in the “Master” GRM registry file. You may need to revisit the “Master” GRM registry file to tune its “MaxResources” value.
- ☐ Finish off registry file editing by revisiting “Master” registry file. As a final step you will tune the “MaxResources” entry count by ensuring that it is sufficient for the number of resources in the “Master” GRM registry and the GRM registries on all of the “Node” network computers.